The World's Reactors

No. 35 Piqua Nuclear Power Facility

OWNER: U.S. Atomic Energy Commission.

BUILDER: Atomics International.

OPERATOR: City of Piqua.

PURPOSE: Power demonstration (supplying steam to existing generating equipment).

LOCATION: S.E. of the city of Piqua, Ohio.

TYPE: Thermal, heterogeneous, organic moderated and cooled.

PROGRAMME: Construction commenced: July 1959.
Operation: Spring 1962.

CAPACITY: 45·5 MW(th).
11·4 MW(e) net.

FUEL: Enriched (1·94%) U alloy.
Alloy: 3·5 w/o Mo, 0·1 w/o Al.
U^{235} investment: 134 kg.
Fuel elements comprise two concentric alloy tubes in s.s. tubular channel, 5·21 in o.d. × 3·08 in i.d.
Outer fuel tube: 4·63 in mean dia.
Inner tube: 3·60 in mean dia.
Alloy thickness in each tube: 0·208 in.
Cladding: finned aluminium, 0·035 in wall.
S.S. channel wall: 0·01 in.
Length of element: active 54 in, overall 80·5 in.
Max. allowable surface temp. (steady state): 750°F (399°C).
T_{sm} at rated power: 713°F (378°C) at core periphery (limiting element);
701°F (372°C) (max. power element).

CORE: Dimensions: approx. cylinder, 60 in dia.
L/D ratio of core: 1·23.
Lattice: 6 in triangular pitch.
No. of elements: 85.
Core loading: 6 900 kg U.
Heat flux in core: max., 89 500 Btu/ft²h;
average: 34 600 Btu/ft²h;
burn-out: 450 000 Btu/ft²h.
Core composition (v/o): U alloy, 17·2%; moderator 69·9%.
Al, 12·1%; stainless steel 0·8%.
Average burn-up per element: 275 MWd.
k_{eff}, hot, clean: 1·068.
Temperature coefficient (550°F): $-7{\cdot}5\times10^{-5}$/°F.
Thermal flux in fuel: av., $1{\cdot}4\times10^{13}$ n/cm²s;
max., $5{\cdot}5\times10^{13}$ n/cm²s.
Peak/average flux ratios, radial and axial, 1·47.
Excess reactivity at start of equilibrium burn-up cycle (hot): 6·8%
Equilibrium Xe and Sm .. .. 3·2%
Burn-up .. .. 1·8%
Flux flattening and control margin .. .. 1·8%

CONTROL: No. of control rods: 13.
Material: Boron carbide.
Total worth: 12·2% $\Delta k/k$.
Shutdown margin: 4·34 $\Delta k/k$.
Active length: 48 in, travel: 48 in.
Diameter: 2·582 in.
Max. withdrawal rate: 0·008% Δk/s.
Release time: 0·08 s.
Total scram time: 0·725 s.

NT/RATOR: Isomeric mixture of ortho- meta- and para-terphenyls.
Inlet temperature: 518°F (270°C).
Outlet temperature: 575°F (301°C).
Flow rate: 12 000 gal/min ($5{\cdot}5\times10^{6}$ lb/h).
Max. coolant velocity through fuel element: 12·7 ft/s.
Normal operating pressure: 120 psia.
Pressure drop through core: 27 psi.
Boiling point at minimum operating pressure: 913°F (489°C);
at atmospheric pressure: 700°F (371°C).
Heat transfer coefficient (max.): 1 300 Btu/ft²h.

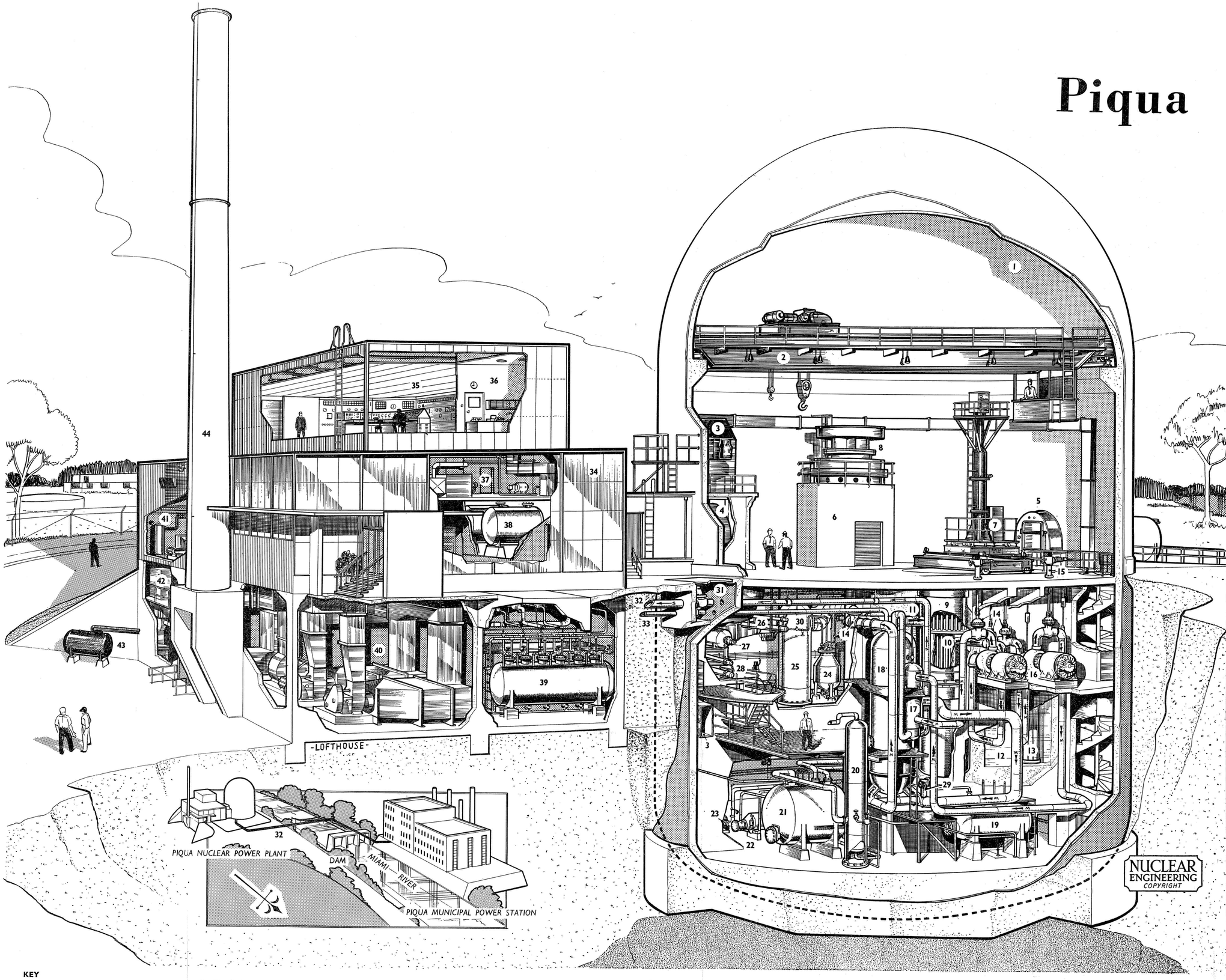
PRESSURE VESSEL: Design pressure: 300 psi.
Height: 27 ft 3½ in.
Inside diameter: 92 in.
Material: Carbon steel.
Thickness: 2½ in and 1⅛ in.

HEAT TRANSFER: No. of coolant pumps: 2 in parallel.
Capacity: 6 000 gal/min each.
Total pressure drop, main loop: 90 psi.
Pressurizing pump flow rate: 200 gal/min.
Purification flow rate: 258 lb/h.
Coolant make-up: 60 lb/h.
Volume of heat transfer system (total): 13 300 gal.
Core tank volume: 7 700 gal.
Core tank volume below coolant nozzles: 4 600 gal.
Heat required to raise temperature of coolant below nozzles from inlet temperature to atmospheric boiling point: $3{\cdot}4\times10^{6}$ Btu.
Coolant temp. entering superheater: 575°F (301·6°C).
Coolant temp. entering boiler: 571·3°F (299°C).
Feedwater temperature: 268°F (131°C).

STEAM CONDITIONS: Drum pressure: 445 psi.
Temp. at superheater: 550°F (288°C).
Steam flow: 150 000 lb/h.
Heat duty (boiler): $145{\cdot}3\times10^{6}$ Btu/h.
Superheater: 103×10^{6} Btu/h.

SHIELDING: Thermal shielding: concentric carbon steel shields inside tank, inner 1·5 in, outer 4 in thick.
Biological shielding: Ordinary concrete, 8 ft thick.

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KEY

1. Containment building
2. Polar crane
3. Ventilation equipment
4. Personnel airlock
5. Equipment airlock
6. New fuel storage room
7. Fuel handling cask
8. Rotating cover (in storage)
9. Reactor
10. Coolant outlets
11. Coolant inlet
12. Fuel storage pool
13. Shipping cask
14. Motorized valves
15. Valve actuators
16. Primary coolant pumps
17. Superheater
18. Boiler
19. Surge tank
20. Relief scrubber
21. Reactor building drain tank
22. Decay heat exchanger
23. Pressurizing pumps
24. F.E.L.S. tank
25. Degasifier
26. Degasifier condensers
27. Shield cooling tank
28. Shield cooling heat exchanger
29. Bypass control valve
30. Purification bleed
31. Valve pit
32. Main steam line
33. Steam dump line
34. Auxiliary building
35. Control room
36. Instrument repair shop
37. Heating and ventilating room
38. New coolant storage tanks (outside)
39. Aqueous waste tank
40. Exhaust and filter room
41. Compressor room
42. Waste fired boiler room
43. Propane tank
44. Stack
M. Moderator/coolant
S. Steam

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